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Abstract

CHOICE OF SOME OPTIMUM CHARACTERISTICS OF CONTROL ELEMENTS FOR NUCLEAR REACTORS

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The first part of this paper describes a method of determination of optimum burnable absorber characteristics and the technique of distributing them over the core to flatten the shape of heat release during the reactor life-time.

Requirements for the absorption cross-section of burnable isotopes and some techniques of using burnable absorbers are formulated. A possibility of reaching zero unbalance of reactivity is discussed based on an ideal case of infinite absorption cross-section. The practical recommendations for choosing the geometry of rods are given on the basis of this analysis. As specific examples the following practically important types of burnable absorbers are investigated:

(1) homogeneous,
(2) non-large self-shielding factor,
(3) large macroscopic absorption cross-section.

The second part of this report deals with the method of determining optimum composition of an arbitrary mixture of resonant absorbers for control rods from the standpoint of increasing rod efficiency, decreasing distortions of neutron fields due to the rods etc.

The method is illustrated by an example of optimum mixture corresponding to the maximum efficiency of rods of given dimensions in intermediate reactor $\Pi\Phi - 4$ $/\frac{\rho_{Bs}}{\rho_U} = 90/$. Efficiency increases by 30% (compared with those of the same sized Ir rod) were observed for optimum mixture of Ir, Re, Eu, Dy, Hf.

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This method has also been used to calculate the optimum plate control rod composition for water-moderated water-cooled reactor/$\frac{\rho_H}{\rho_u} = 280$/ , corresponding to minimum neutron field distortions near these rods.

Calculated results are compared with experimental data.